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THE PTERIDOPHYTES OF GOUGH ISLAND

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Abstract

The habitats of the twenty-six species of pteridophytes on Gough Island are given.

Uittreksel

DIE PTERIDOFIETE VAN GOUGH-EILAND

Die habitatte van die ses-en-twintig varingsoorte wat op Gough-eiland aangetref word, word beskryf.

Introduction

Gough Island, S 40° 19′ 19″, W 9° 53′ 42″, is situated in the mid-south Atlantic ocean and may be regarded as the most outlying island of the Tristan da Cunha group.

This island was first discovered as early as 1505 when it was uninhabited. During the 19th century it was often occupied for short periods and frequently visited when a few, scanty collections of plants were occasionally made. During the mid-20th century the Gough Island Scientific Survey team stayed there from 1955 to 1956.

This was the first survey ever done on the vegetation of Gough Island. Wace (1961), the botanist of the survey team recorded twenty-seven pteridophyte species which was a considerable increase in the number previously known from the island.

Rudmose Brown (1905), mentions ten species of ferns in his paper on the botany of Gough Island and twenty years later, Wilkins (1925), recorded only nine species for the island.

The present author visited Gough Island during the period September to October 1979 in order to study its pteridophytic flora. It was only then that it was realised that three of the species listed by Wace (1961) could not be included in this paper. Wace listed names attached to his collections but these were not checked by a systematist. They were names of any previous Tristan or Gough Island records. The three deleted species are *Lycopodium insulare, Elaphoglossum hybridum* and *Polystichum mohroides*.

The present author recorded twenty-six species of pteridophytes for the island.

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A list of names which differ from Wace's paper is given below.

Wace	Roux
Gymnogramma cheilanthoides	Eriosorus cheilanthoides
Dryopteris aquilina	Ctenitis aquilina
Dryopteris paleacea	Dryopteris parallelogramma
Thelypteris tomentosa	Amauropelta bergiana var. tristanensis
Asplenium alvaradense (mis-spelled)	Asplenium alvarezense

CLIMATE

The climate of Gough Island has been described as temperate (Wace, 1961). Mean temperatures at the meteorological station at Transvaal Bay between the years 1971 to 1975 at an altitude of 54 m were a maximum of 18,6 °C in February and a minimum of 5,7 °C in July.

An very uneven precipitation pattern occurs on the island. The average rainfall is 3 057 mm per annum. Rain is very frequent with a maximum of 512 mm being recorded in March and a minimum of 80 mm during January for the period from 1971 to 1975. Wace (1961), reported rainfall at an altitude of 600 m from Barren Dome to be 1,5 times as much as that for the same period at Goncalo Alvarez at an altitude of ± 20 m.

With such a high rainfall the average humidity is 80 % and constant throughout the year. Mean humidities recorded on the island are: maximum 82 % for the months July to August and a minimum of 77 % in December.

Mist is frequent on the island but more so at altitudes above 740 m. The sky is usually cloudy which reduces the sunshine on the island to a very large extent. Maximum sunshine is in October when an average of 7,1 hours per day can occur. This drops to an average of 1,96 hours per day in June.

Snow is frequent there in the winter months at elevations above 450 m. However temperatures never drop to freezing point at lower altitudes.

The prevailing wind is westerly and can often reach gale force.

VEGETATION

The age of Gough Island in relation to its vegetation is discussed by Hafsten (1960). Since its discovery in 1505 no signs of any volcanic activity have been reported. Bands of volcanic ash which probably originated from the island itself occur in peat at an depth of 1 350 mm on Albatross Plain. These have been dated at 2 345 years (Wace, 1961). Pollen analyses of peats above and below these depths reveal that any volcanic activity had a negligible effect on the island's plant life.

The bottom of the peat profile on Gough Island has been dated at 4 720 years. There is thus no definite evidence from the peat deposits of any vegetation more than 5 000 years of age.

The conclusion is that the intermittent volcanic activity that did take place during the last few thousand years had little effect on the island's vegetation which at present varies from sub-Arctic to cool temperate in character.

Wace (1961), illustrated that the degree of exposure, as well as altitude are the prime factors which are correlated with the distribution of the present formation. Rock formations are important in influencing the vegetation mainly as in weathering, they have given rise to differing topographies.

In general, the formation with structural similarities to sub-Arctic vegetation is concentrated on the windward or western side of the island. Those of temperate affinities are mainly on the leeward or eastern side, or in sheltered situations.

Five distinct types of vegetation are recognized (Wace, 1961). Each of these formations comprises several different communities. The five major vegetation types can be described as follow: (Fig. 1).

Tussock Grassland

This vegetation type consists of communities of large grasses such as *Poa flabellata* and *Spartina arundinaceae* which form stout tussocks up to 2 m tall which cover most of the cliffs and off-lying sea-stacks.

Fern Bush

Fern bush is very dense and consists of thickets of *Phylica arborea* interspersed with *Histiopteris incisa* and *Blechnum palmiforme* heath. It occurs below 300 m in the south and east as well as in a few sheltered glens to the north. The *Phylica, Blechnum* and *Histiopteris* communities are collectively termed fern bush.

Wet Heath

Stunted *Blechnum palmiforme, Empetrum rubrum* and various grasses are dominant in this vegetation type which lies between 300 and 600 m above sea level and forms the intermediate zone bordering on all the other vegetation formations on the island, containing thus elements of them all.

Moorland, verging to Feldmark and Montane Rock

Wet heath vegetation can develop up to the highest points on Gough Island in parts where there is protection from prevailing winds. This usually enables peat to accumulate. The area above 600 m is mostly exposed and windswept and bears a montane moorland vegetation on thin mineral soils. In places it verges to feldmark and bare rock.

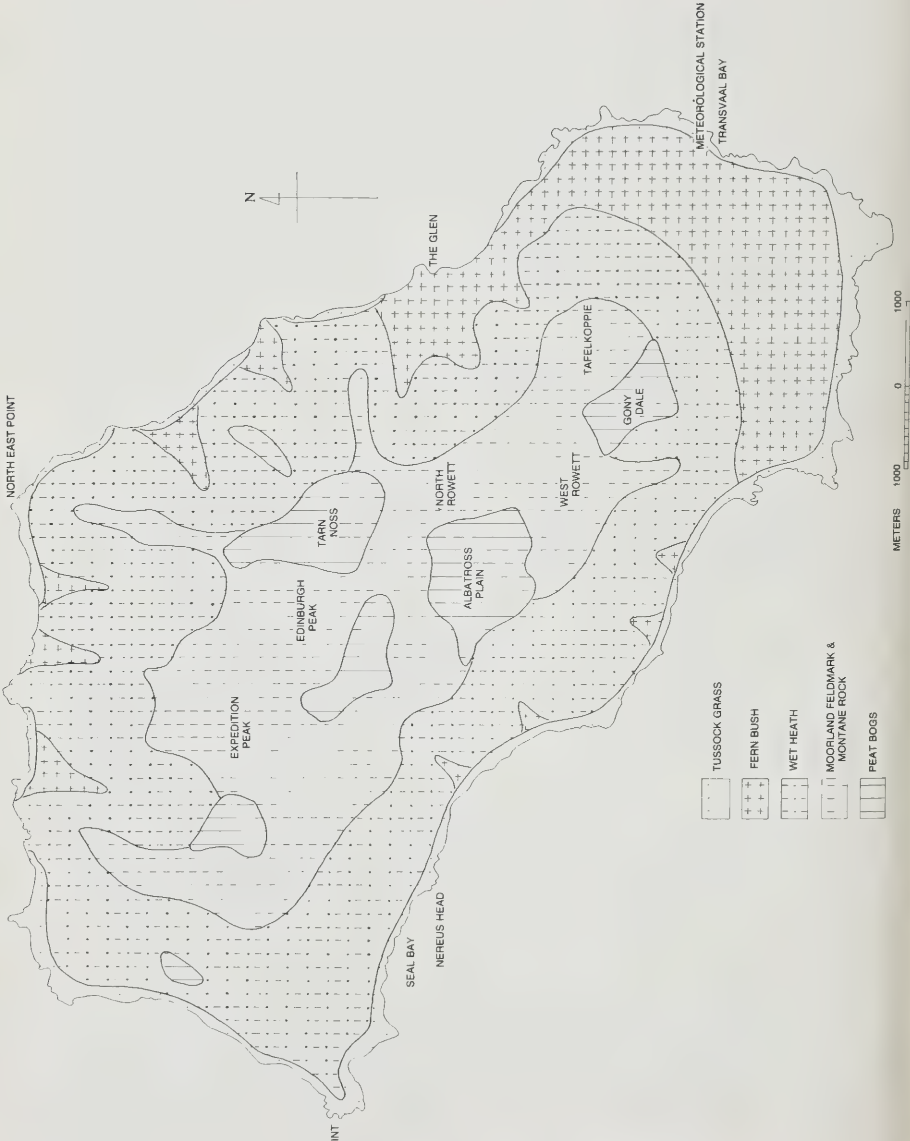

FIG. 1.
Vegetation types of Gough Island.

Peat Bogs

Two different types of bogs bearing two different types of vegetation are found on the upland areas where both valleys and plateaus have impeded drainage.

PTERIDOPHYTE DISTRIBUTION ON GOUGH ISLAND

There is an very uneven distribution pattern of pteridophytic taxa which can be ascribed to the topography as well as to the climatic conditions (Fig. 2).

Sub-Arctic as well as temperate vegetation occurs on the island as the topography is such that typical sub-Arctic conditions are created by the prevailing westerly wind. Cosmopolitan south-Arctic species such as *Lycopodium saururus*, *L. magellanicum*, *Ophioglossum opacum*, *Hymenophyllum peltatum*, *Grammitis billardieri* and *Blechnum penna-marina* are common in these sub-Arctic conditions.

The temperate species are mainly confined to the lower southern and eastern parts of the island which are protected from the westerly wind. Species such as *Hymenophyllum aeruginosum*, *Histiopteris incisa*, *Hypolepis rugulosa*, *Rumohra adiantiformis*, *Asplenium lunulatum*, *A. polyodon*, *A. insulare* and *Blechnum punctulatum* are found in these areas.

Many of these species which originate from the temperate parts of South

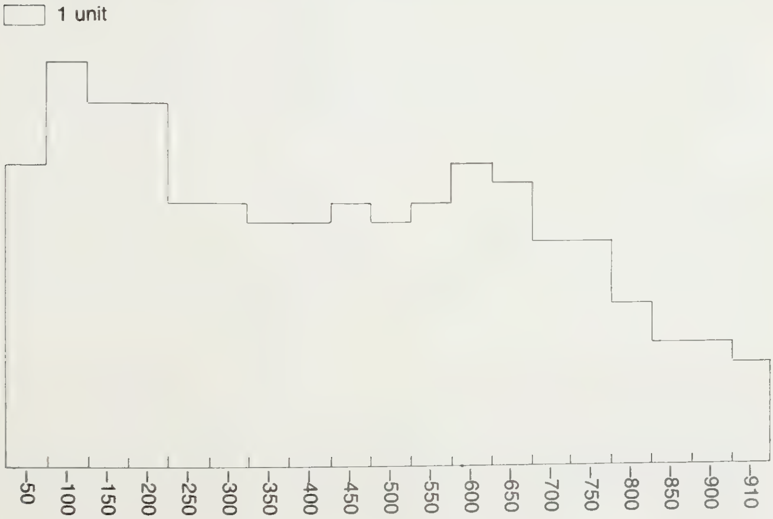

FIG. 2.
Dendogram showing distribution of pteridophytes on Gough Island.

America have adapted to withstand conditions on the western parts of the island. These plants are usually stunted or grow in protected crevices. Such species are *Hymenophyllum peltatum, H. aeruginosum, Ctenitis aquilina, Elaphoglossum laurifolium, E. succisifolium* and *Eriosorus cheilanthoides*.

To summarise, only 29 % of the pteridophytes occur at all altitudes and are fairly evenly distributed over the entire island. 19 % of the taxa are mainly confined to the exposed sub-Arctic conditions with the remaining 52 % confined to the temperate conditions. A reduction in the number of taxa is experienced as the altitude increases (Fig. 2). This can be ascribed to the exposure of the upper parts as well as an increase in rain and a reduction in temperature.

There are twenty-six pteridophyte species recorded on the island and these belong to eleven families which are all cosmopolitan.

A single species, *Asplenium alvarezense* Rud. Br. is endemic to Gough Island.

LYCOPODIACEAE

Lycopodium saururus Lam., Encycl. Méth., Bot. **3**: 653 (1789).

Terrestrial or lithophytic. Plants are large and many-stemmed when growing on protected slopes and among other vegetation on the higher southern and eastern slopes. Depauperate forms are common in bogs and on windswept ridges. Common at altitudes above 600 m. *Roux 743,751* (NBG).

Lycopodium diaphanum Sw., Syn. Fil.: 179 (1806).

Plants were recorded at most conditions on the island. It is more common as a pioneer where peat slides have occurred. Seldom found in shaded conditions. Widely distributed on the island between altitudes from 100 to 550 m. *Roux 725, 758* (NBG, K).

Lycopodium magellanicum Sw., Syn. Fil.: 180 (1806).

Terrestrial or lithophytic. Depauperate forms are common on exposed windswept ridges. Larger plants are confined to taller vegetation and protected conditions. Common on higher (600–900 m) altitudes of the island. *Roux 752, 761* (NBG).

OPHIOGLOSSACEAE

Ophioglossum opacum R. Br., Prodr. fl. Nov. Holl.: 164 (1810).

This species is deciduous. Active growth starts in October. Growing conditions vary from waterlogged bogs to slightly drier slopes. Common at all altitudes between 550 and 750 m on the exposed western parts of the island. *Roux 770, 771* (NBG).

HYMENOPHYLLACEAE

Hymenophyllum aeruginosum (Poir.) Carm. in Trans. Linn. Soc. **12**: 518 (1818).
Trichomanes aruginosum Poir. in Lam., Encycl. Méth. Bot. **8**: 76 (1808).

Litho—or epiphytic. This species is common in the south and east areas of the island where it grows in deep shade. Common as a epiphyte on the stems of *Blechnum palmiforme*. Confined to rock crevices at higher altitudes and on exposed western areas. Fairly common all over the island at altitudes between 50 and 950 m. *Roux 717* (NBG, K), *742* (NBG).

Hymenophyllum peltatum (Poir). Desv., Prod. 333 (1827).
Trichomanes peltatum Poir. in Lam., Encycl. Méth. Bot. **8**: 76 (1808).

Litho—or epiphytic. Common as an epiphyte to the south and east of the island on the stems of *Blechnum palmiforme*. Confined to rock crevices and also slight protection in the west where depauperate forms of this species are quite frequent. Common at all altitudes and aspects of the island. *Roux 720, 741, 765* (NBG).

DENNSTAEDTIACEAE

Histiopteris incisa (Thunb.) J. Sm. in Hist. Fil. 295 (1875).
Pteris incisa Thunb. in Prodr. Pl. Cap. 171 (1800).

This is the most common fern species on the southern and eastern parts of the island. The species is deciduous but fronds may reach a length of 1 m. On the lower south-eastern slopes the plants form the dominant vegetation. Mainly confined to the southern and eastern areas of the island at an altitude of 650 m. Very occasionally found in swallow holes above this height.

"*Histiopteris incisa* occurs sporadically in most of the more sheltered communities up to 600 m above sea level. In the glens and on the Southern slopes it dominates extensive areas, often with few associates. At 15 m above the sea near Goncalo Alvarez, loosely packed and moist peat up to 1 m deep is covered by a dense layer of *Histiopteris* with the fronds as much as 90 cm long." (Wace, 1961: 344). Wace (1961: 345) later states,". . . in open *Phylica* bush, *Histiopteris incisa* and *Dryopteris aquilina* often form a dense layer beneath the trees up to 1 m in height." *Roux 733* (NBG, K, BOL).

Hypolepis rugulosa (Lab.) J. Sm. in Bot. Mag. **72** Comp. 8 (1846).
Polypodium rugulosum Lab., Nov. Holl. pl. spec. 2 (1806).

A terrestrial species confined to streambanks where it is often found growing in shaded conditions. Plants at lower altitudes near the coast are regularly sprayed by waves during heavy seas. A species fairly common on the lower (50–500 m) southern and eastern parts of the island. *Roux 723* (NBG), *745* (NBG, K, BOL).

VITTARIACEAE

Vittaria vittarioides (Thouars) C. Chr., Ind. Fil. 655 (1907).

Pteris vittarioides Thouars, F1. Trist. d'Ac. 31, t. I (1804).

Litho—or epiphytic. A species more frequent on well-protected shaded stream-banks. Depauperate forms are found as epiphytes on the stems of *Blechnum palmiforme*. Confined to altitudes below 150 m to the south and east of the island. *Roux 722* (NBG, K).

ADIANTACEAE

Adiantum poiretii Wikstr. in Vet. Akad. Handl. 443 (1825).

The plants are usually confined to sheltered positions on the lower (50–200 m) southern and eastern slopes where they grow as individuals but often in large masses. Common on the southern sea-facing cliffs near the meteorological station. *Roux 748* (NBG, K, BOL), *754* (NBG)

Eriosorus cheilanthoides (Sw.) A. F. Tryon in Brit. Fern Gaz. **9**: 271 (1966).

Grammitis cheilanthoides Sw., Syn. Fil. **23**: 219 (1806).

Terrestrial. A plant adapted to the higher parts of the island. Usually found in moss among rocks which provide some protection. Fairly common between 450 and 750 m. At 450 m the plants are much bigger than those at higher altitudes. Confined to the higher parts of the island. Frequent on the Rowetts. Not observed on the northern parts of the island. *Roux 729* (NBG).

GRAMMITIDACEAE

Grammitis billardieri Willd., Sp. Pl. ed. 4, **5**: 19 (1810).

A lithophytic plant mainly confined to the higher parts of the island. Common in rock crevices sheltered from the prevailing westerly winds. Depauperate forms are frequent on exposed rock-faces. This species is relatively common at altitudes above 600 m but may be found at lower levels on the western parts of the island. It does not occur on the eastern parts. *Roux 744, 763, 764* (NBG).

ASPLENIACEAE

Asplenium alvarezense Rud. Br. in J. Linn. Soc. Bot. **37**: 247 (1905).

Endemic to Gough Island. Terrestrial to epiphytic. Usually found in shade on all aspects and in all conditions on the island. Common as an epiphyte on the stems of *Blechnum palmiforme*. Confined to rock crevices and other sheltered positions on the western parts and at higher altitudes. More common in the south and east.

Wace, (1961: 342) says, ". . . and *A. alvarezense* on the sides of the tussock stools are often the only associated species." This he observed in penguin rookeries. He later says, (1961: 344), ". . . 15 m above sea near Goncalo Alvarez . . . *A. alvarezense* are abundant on dead *Phylica* logs, . . .", "Where the surface is very uneven, and where more light reaches the ground, *A. alvarezense* dominates the ground layer . . ." *Roux 715* (NBG), *769* (NBG, K).

Asplenium insulare Carm. in Tr. Linn. Soc. **12**: 512 (1818).

A species observed on the lower eastern slopes of the island. Fairly common but easily overlooked. Usually in exposed conditions among *Histiopteris incisa* but on a few occasions plants were found on streambanks in light shade. Confined to the lower (50–100 m) southern parts of the island. *Roux 737* (NBG, K).

Asplenium lunulatum Sw. in Schrad., Journ. Bot. 1800, **2**: 52 (1801).

Terrestrial. Confined to deep shade and well-sheltered positions which are constantly moist. Observed at two localities on the island. The first, 30 m above sea-level at the waterfall west of the meteorological station and the other 20 m above sea-level in the Glen. *Roux 749* (NBG, K), *768* (NBG).

Asplenium polyodon Forst. f., Prodr. 80 (1786).

Terrestrial. Not a very common plant and easily overlooked. Usually found in full sun among *Histiopteris* and *Asplenium obtusatum*. Confined to the lower (50–100 m) southern aspects of the island. *Roux 730* (NBG, K).

Asplenium obtusatum Forst. f., Prodr. 80 (1786).

Terrestrial. Plants can obviously withstand severe conditions as they were located near sea-level where they are regularly within the spray-zone of the sea. Plants are also found in the open and in the shade of *Phylica arborea* but rarely under the canopy of these trees. Common in the south and east of the island up to an altitude of 200 m.

Wace, (1961: 342), made the following observation in a penguin rookery, ". . . and *Scirpus sulcatus* overlying the rocks, and *A. alvarezense* and *A. obtusatum* on the sides of the tussock stools are often the only associated species." He also says "On the very broken slopes below 300 m in the South-east of the island, *Histiopteris* is partially replaced in the fern bush by *Asplenium obtusatum* and . . . this species can withstand considerable exposure to salt spray, and . . ." (Wace, 1961: 344). *Roux 728, 732* (NBG), *753* (NBG, K).

THELYPTERIDACEAE

Amauropelta bergiana (Schlechtend.) Holtt. var. **tristanensis** Holtt. in Jl S. Afr. Bot. **40** (2): 134 (1974).

Terrestrial. Fairly common along streambanks in very moist and shady conditions. Exposed plants usually smaller. Confined to the lower southern parts of the island below an altitude of 300 m. *Roux 714, 746* (NBG).

LOMARIOPSIDACEAE

Elaphoglossum laurifolium (Thouars) Moore in Ind. 14 (1857).

Acrostichum laurifolium Thouars, Fl. Trist. d'Ac. 31 (1804).

Terrestrial, litho- or epiphytic. A very variable species in size due to the climatic conditions on the island. Depauperate forms are common on the higher and western parts. Widespread over the entire island. Common in the southern and eastern parts. Not recorded at an elevation above 640 m.

Wace, (1961: 344) says, ". . . *Elaphoglossum laurifolium* is abundant on dead *Phylica* logs, . . ." This observation was made at Goncalo Alvarez. *Roux 718, 738* (NBG), *724* (NBG, K).

Elaphoglossum succisifolium (Thouars) Moore in Ind. 15 (1857).

Acrostichum succisifolium Thouars, Fl. Trist. d'Ac. 31 (1804).

Terrestrial, litho- or epiphytic. A species very variable in size. Common in the south and east where it is found in exposed conditions and along streambanks in deep shade. Exposed plants are usually depauperate and generally confined to the western parts of the island. Widespread on the island below an altitude of 650 m. *Roux 719* (NBG, K), *727, 750, 766* (NBG).

ASPIDIACEAE

Ctenitis aquilina (Thouars) Pic. Ser. in Webbia **28:** 468 (1973).

Polypodium aquilinum Thouars, Fl. Trist. d'Ac. 32 (1804).

Dryopteris aquilina (Thouars) C. Chr. in Ind. Fil. 252 (1905).

Terrestrial. This is one of the few plants which thrive in the relatively deep shade of *Phylica arborea*. Plants are common on streambanks but are more irregularly spread in exposed conditions where they are usually very stunted and only a few fronds are produced. At high altitudes often only a single frond protrudes from the dense formation of grass and mosses. This species is more common on the southern and eastern parts but is frequently found on the upper and western parts of the island. Here the plants are more confined to rock crevices. No plants were observed above 800 m.

Wace, (1961: 345) says, ". . . and *Dryopteris aquilina* often form a dense layer beneath the trees up to 1 m in height." *Roux 716, 735* (NBG, K, BOL).

Dryopteris parallelogramma (Kunze) Alston in Amer. Fern Journ. **47**: 92 (1957).

Aspidium parallelogrammum Kunze in Linn. **13**: 146 (1839).

Terrestrial. A fern species common in the east of the island where it is usually found in very wet conditions on streambanks. Plants were observed in exposed as well as in shaded conditions and no remarkable variation was noted.

The plants usually grow in small groups and develop an erect caudex of up to 200 mm high and 80 mm in diam. Mainly confined to the eastern parts of the island but a single plant was observed at an altitude of 410 m on the southern slopes of Tafelkoppie. In the eastern parts no plants were observed above an altitude of 300 m. *Roux 740* (NBG), *767* (NBG, K, BOL).

Rumohra adiantiformis (G. Forst.) Ching in Sinensia **5**: 70 (1934).

Polypodium adiantiforme G. Forst., Prod. 82 (1786).

Aspidium capense Willd. Sp. Pl. ed. 4, **5**: 267 (1810).

Terrestrial. These plants form dense stands on the exposed lower southern and eastern parts of the island, resulting in fronds that are relatively smaller and scorched. Active growth takes place during October. Frequent at coastal areas in the south and east. Scarce on the higher parts but frequent along the Albatross Plain margin. Not observed above 660 m.

"On the very broken slopes below 300 m in the South-east of the island *Histiopteris* is partially replaced in the fern bush by . . . and *Rumohra adiantiformis* . . . this species can withstand considerable exposure to salt spray . . ." (Wace, 1961:344). *Roux 739* (NGB, K, BOL).

Blechnaceae

Blechnum palmiforme (Thouars) C. Chr. in Christoph. Results Norw. Sc. Exp. Trist. d'Ac. **6**: 10 (1940).

Pteris palmiformis Thouars, Fl. Trist. d'Ac. 30 (1804).

Terrestrial. Common and well developed on the lower southern and eastern parts and widespread over the rest of the island. Plants reduce in size as altitude increases. Stems of up to 1,25 m high were measured on the lower (below 500 m) elevation but the plants are small and usually confined to sheltered positions at the higher altitudes. Numerous new fronds are produced simultaneously during October on the lower parts. No sign of any growth was visible on the upper parts.

Wace, (1961: 344) says, "In the fern bush it dominates extensive areas of ground, often with no associated species except fern epiphytes. The trunks of the *Blechnum* lie in a confused tangle, with their procumbent lower parts buried in the peat, and the upper parts, which are invariably covered in a thick layer of epiphytic ferns, producing a crown of stiff fronds up to 1 m in diameter and often over 1,5 m above ground." He also observed that "Neither *Blechnum palmiforme* nor *Histiopteris incisa* grow in places exposed to much salt spray. . . ." (Wace, 1961: 350). *Roux 736* (NBG, K, BOL).

Blechnum penna-marina (Poir.) Kuhn, Fil. Afr. 92 (1868).

Polypodium penna marina Poir. in Lam., Encycl. Méth. **5**: 520 (1804).

Terrestrial, litho- or epiphytic. A very adaptable species. In the south and east the plants are confined to sheltered conditions along streambanks and cliffs. On the upper, more exposed parts plants are more common but very depauperate. This species was observed at all altitudes. Common and widespread over the entire island.

"At 330 m above sea level . . . *Blechnum penna marina* also grow as an epiphyte, . . . on the trunks of the tree-ferns." (Wace, 1961: 351). *Roux 726* (NBG), *755* (NBG, K), *721* (K).

Blechnum punctulatum Sw. in Schrad., Journ. Bot. 1800, **2**: 74 (1800).

Terrestrial or lithophytic. Plants grow in small groups in continual shade of cliffs or of *Phylica arborea*. At Transvaal Bay the plants are also regularly sprayed by the sea. Very localized in the south and east below an altitude of 200 m. *Roux 731, 747* (NBG, K), *757* (NBG, K, BOL).

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